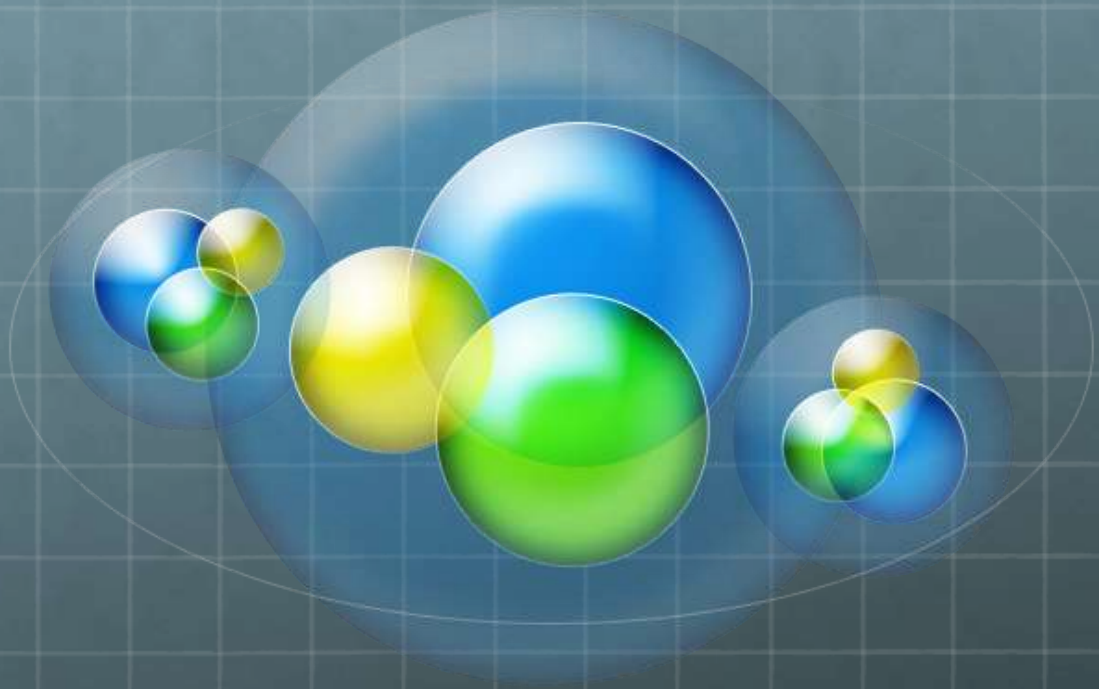


MATTER

Stuff.

Bellwork 9-14-16

- A 45.6g sample of Nickel is poured into a graduated cylinder with 30.61 mL of water. If the water rises to 35.72mL, what is the density of the Nickel in g/cm^3?

- Objective: determine different ways to distinguish substances, and use the particulate model of matter to explain the properties of solids, liquids, and gases.

MATTER

- Demonstration
  - 3 test tubes of clear liquids
  - 3 white powders.
- How can we distinguish between these substances, given they are actually different?
  - Discuss with your lab group and come up with
    - 3 ways to distinguish between the powders
    - 3 ways to distinguish between the liquids
      - Try to justify your reasons!

MATTER

- In groups, discuss the following
  - In what situations would it be important to be able to distinguish between different substances?
    - Try to come up with three. They can be real or hypothetical.
  - What would be the consequence of failing to do so?

MATTER

- Potential cases in which determining substances is useful:
  - Health monitoring
    - Blood tests, Medical imaging dyes, drugs
  - Crime investigation
    - Forensic science
      - Drug tests, explosives tests

MATTER

- Now, we will shift our focus to trying to figure out how matter is made up.
- To do this, we will use a model.
  - Not a fashion model
  - Something that represents a simplified description of a system

PARTICLES

- A simple and effective way to model matter:
  - The Particulate Model of Matter
- Assumptions:
  - Any macroscopic sample of a substance is composed of a LARGE number of small particles.
    - 1mL of water = 3.34×10^{22} particles.
  - Particles are in CONSTANT motion.

PARTICLES

- Particle Simulator:
  - https://phet.colorado.edu/en/simulation/legacy/states-of-matter-basics
- What did the dots represent?
- Limitation:
  - Dots are HUGE compared to actual particles

SOLIDS

- Solid substances have the following properties
  - Particles tightly packed, vibrate slowly
  - Incompressible, fixed volume
  - Rigid

- Think of 3 examples of solids you have encountered outside of the classroom.

LIQUID

- Liquids have the following properties:
  - Particles further apart, able to move around each other, vibrate quickly
    - Able to flow
  - Have nearly fixed volume, somewhat compressible
  - Assumes the shape of the container its in.

- Think of 3 types of liquids you have encountered outside the classroom.

GAS

- Gases have the following properties:
  - Particles far apart, move quickly, able to flow
  - Fill the volume of the container its in.
  - Compressible

- Think of 3 types of gases you have encountered outside the classroom.

Closure

- Not being able to distinguish between different substances can have mild to disastrous consequences, so it is important we be able to do so.
- Matter is made up of lots of tiny particles in constant motion.
- Matter can exist in 3 states: solid, liquid, and gas.

Closure

- Explain the similarities and differences between solids, liquids and gases.

Bellwork 9-15-16

- An erlenmeyer flask weighs 40.0g. When filled with water, (density= 1g/cm^3) it weighs 100g. How much does the flask weigh when filled with hexane? (density=0.6548g/cm^3).

MATTER

- Objective: Use the Particulate Model of Matter to explain a phase change, and be able to create a Phase Diagram with all the essential parts.

MATTER

- Yesterday, we learned about
  - Why distinguishing between substances is important
  - How to Model Matter (Particulate Model of Matter)
  - Properties of solids, liquids, gases
- Today, we're going to learn how Temperature and Pressure can affect the particles we looked at.

MATTER

- Particle Simulator:
- You guys are going to give me directions on what to do to the system.
  - Change Temp by heating/cooling
  - Change pressure by changing the Volume
- Record all observations as we go between different temps and pressures
  - Data table??

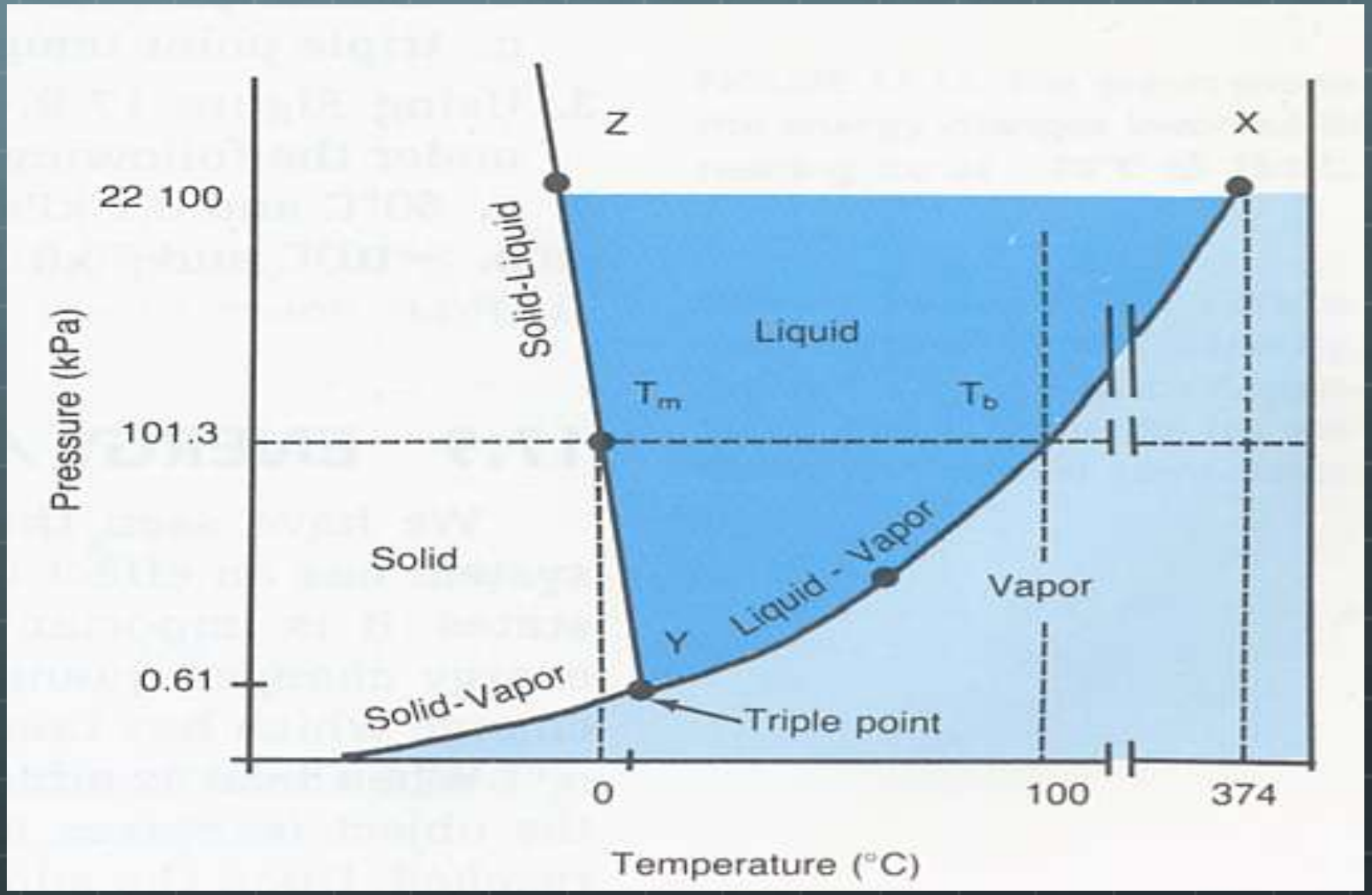
MATTER

- We saw when we adjusted P/T, we could make different states of matter at unexpected temperatures.
- What can we do with this data?
  - (we did this in the density lab)

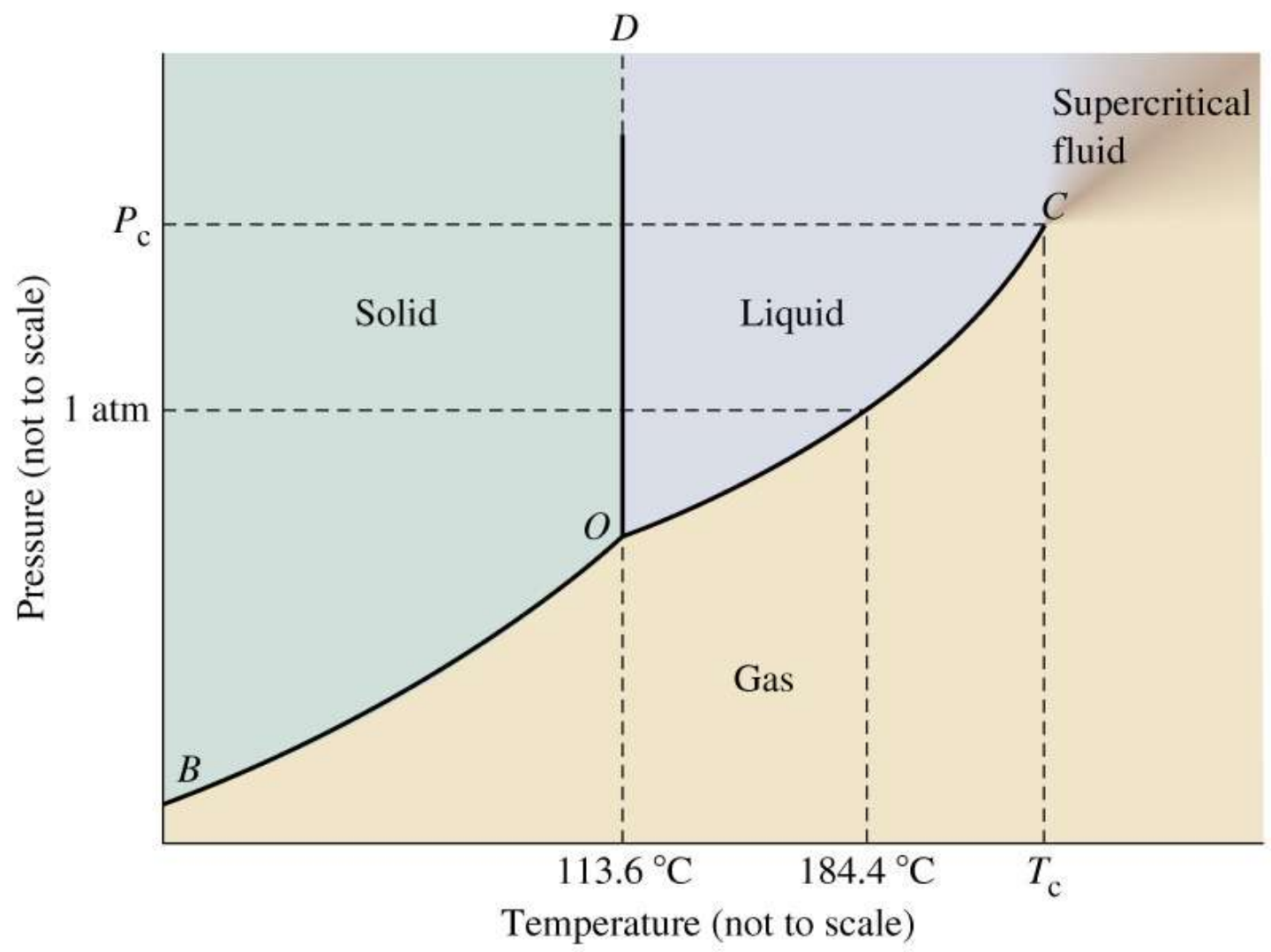
MATTER

- Scientists have done A BUNCH of experiments like this, and are able to come up with complete data sets

MATTER


Z
X
22 100
101.3
0.61
Pressure (kPa)
Solid-Liquid
Liquid
T_m
T_b
Solid
Liquid - Vapor
Vapor
Y
Solid-Vapor
Triple point
0
100
374
Temperature (°C)

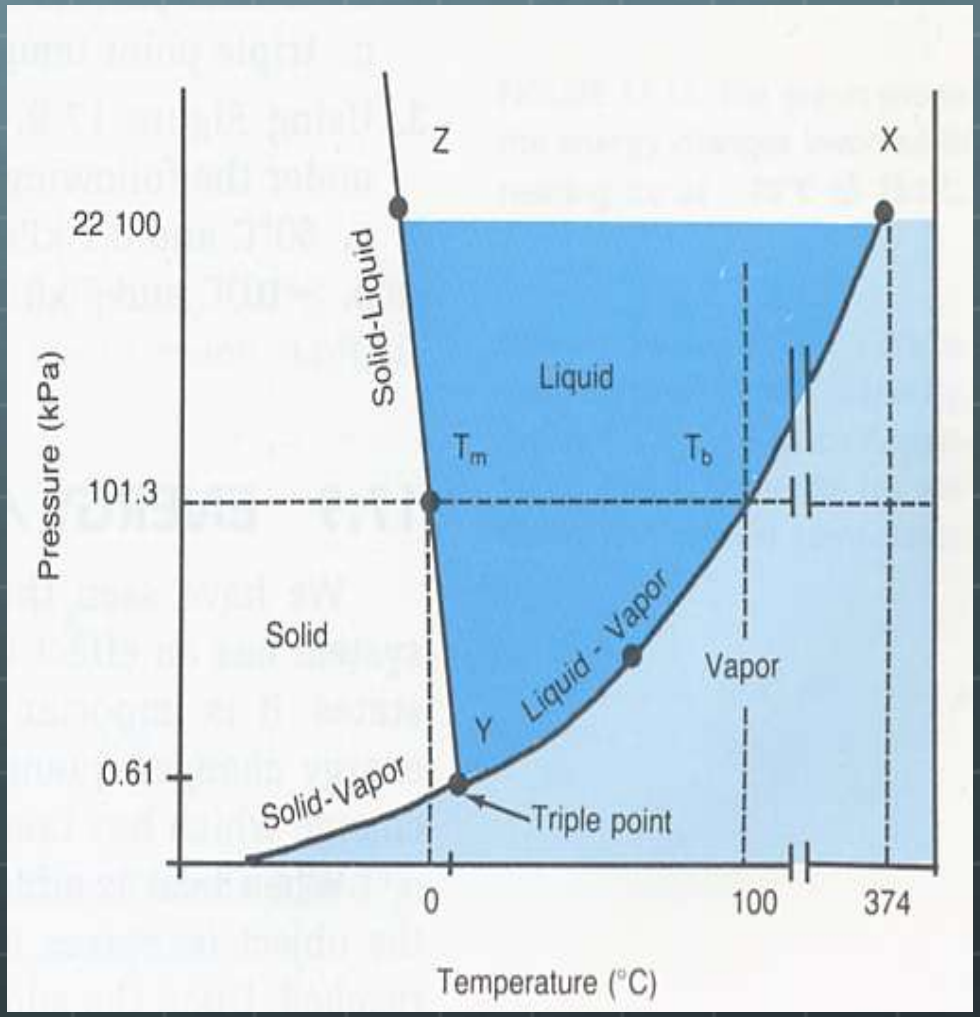
MATTER


D
Supercritical fluid
C
P_c
Solid
Liquid
1 atm
O
Gas
B
Pressure (not to scale)
113.6 °C
184.4 °C
T_c
Temperature (not to scale)

Closure

- Explain what happens during a phase change w/ the Particulate Model of Matter
- Draw a generic phase diagram w/ all the essential parts.

Bell Work 9-19-16



- Start at (0 C, 0.61 kPa). What state are you in?
- Heat sample to 50 C. What happens to your sample?
- Increase the pressure of your sample to 101.3 kPa (still at 50 C). What happens to your sample?

MATTER

- Last week, we started looking at phase diagrams to tell us a what temps/pressures the different states of matter exist for a certain substance
- Objective: To be able to classify matter using a flow chart.

MATTER

- For our cases, matter will be classified into two different categories:
  - Pure Substances,
  - Mixtures
- These categories go beyond the states of matter, and tell us what our matter is composed of.

PURE SUBSTANCES

- Pure substances are composed of only one type of particle.
- These cannot be separated using physical methods like evaporating or filtering.
- Two types of pure substances:
  - Elements: made up of only 1 type of atom.
    - Elements are made of ATOMS – the smallest component of matter that retains all the properties of matter
    - Each element has unique atoms that are unlike the atoms of any other element.

PURE SUBSTANCES

- Two types of pure substances:
  - Elements: made up of only 1 type of atom.
    - Elements are made of ATOMS – the smallest component of matter that retains all the properties of matter
    - Each element has unique atoms that are unlike the atoms of any other element.
- EX: Aluminum in aluminum foil, Oxygen gas in the atmosphere

PURE SUBSTANCES

- The other type of pure substances is Compounds
  - Compounds are made up of only one type of molecule.
    - Compounds are made up of more than one type of atom bonded to each other.
    - The atoms that make up the compounds cannot be separated physically. Only a chemical reaction can separate them.
- EX: Table Salt (NaCl), sugar ($C_6H_{12}O_6$)

MIXTURES

- The other classification of matter is Mixtures.
- Mixtures are made up of different types of particles that CAN be separated by physical means such as filtration and evaporation.
  - Ex: with salt water, all you have to do is evaporate the water to get just salt.

MIXTURES

- There are two types of mixtures:
  - Heterogeneous: The composition varies from one region of a sample to another
    - Ex: air pollution
  - Homogenous: Substances are so evenly distributed that a sample from any one part of the mixture will be chemically identical to a sample from any other part.
    - Ex: sugar dissolved in water.

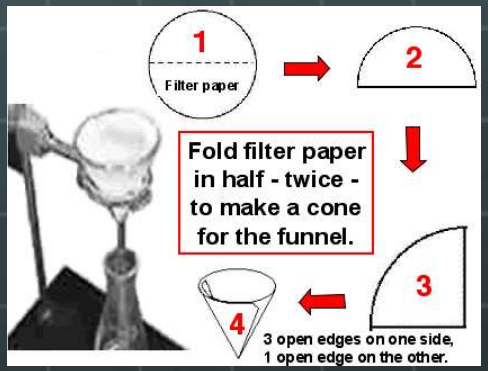
MIXTURES

- What type of mixture is this?

Separation of a Homogeneous Mixture

Separation #2

Separation #1



http://crescentok.com/staff/jaskew/isr/chemistry/liquidkey.htm

Separation #3

Data Set Up

	Mass (g)	Mass Dish + Sample (g)	Mass of Dish after heating (g)	Difference in Mass, loss of mass (g)
Dish A (Steps 1-3)				
NH_4Cl				
Dish B				
Watch Glass				
NaCl				
Filer Paper			(Dry filer paper and solid)	
SiO_2				